

# Patterns of scald injuries

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## Abstract

**Objectives** - To describe common patterns of bath water scald injuries in children, to examine differences between accidental and non-accidental bath water scalds in children, and to examine potential for prevention.

**Design** - A two year six month retrospective analysis of admissions to a specialist burns unit.

**Setting** - The Burns Unit, St Lawrence Hospital, Chepstow serving children from south and west Wales.

**Subjects** - Sixty eight children attending the Burns Unit for treatment of bath related scald injuries.

**Results** - Bath scalds in children under 5 years of age was the cause of 14.7 per 100 000 children being admitted to the specialist burns unit in a year. The majority of the children were injured by falling in the bath but the tap was turned on by seven children themselves and by 10 siblings. Six children put hands in the hot water and two children were accidentally put into bath water that was too hot and were quickly withdrawn. Four children suffered probable non-accidental immersion scald injuries from hot water. They were characterised by a clear tide mark, a story that did not fit the injuries, associated injuries, and by symmetrical lesions. Accidental scalds were irregular geographical injuries and were asymmetrical.

**Conclusions** - Bath scalds are a significant problem in children under 5 years. Their prevention should be part of an injury control programme on a local and national level. The best way to achieve this would be by reducing the temperature in domestic hot water tanks. The recognition of non-accidental bath scalds can be assisted by the pointers outlined and should be done in a multidisciplinary way with plastic surgeons, paediatricians, and social workers working together.

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The bath can be a dangerous place for small children, particularly when unsupervised, where they can drown<sup>1</sup> and be scalded in hot water.<sup>2,3</sup> Both of these injuries commonly result from an accident<sup>4</sup> but they can be due to child abuse.<sup>5,6</sup> Scald injuries to children in the bath are of concern because although the numbers of children who die are small, many are left with disfiguring scars that can influence their whole lives. Injuries include those to hands, feet and the perineum, in which healing

can take a long time, and may cause functional problems. Injuries to children in the bath comprise a significant proportion of thermal burns among children<sup>3</sup> and present important challenges both in prevention and the recognition of those cases which result from abuse. We have reviewed scald injuries in the bath presenting to the Burns Unit at St Lawrence Hospital, Chepstow, which covers south and west Wales, to identify patterns of both accidental and non-accidental scalds to children to help to answer these challenges.

## Methods

We studied children under 15 years of age who had sustained scald injury in the bath. We examined the case records of children from south and west Wales that had been considered severe enough to be referred to a specialist burns unit: St Lawrence Hospital, Chepstow, Gwent. This unit covers the counties of Gwent, South, Mid and West Glamorgan. Dyfed (including Pembrokeshire), and South Powys and admits all children with burns and scalds that need specialist treatment from that area. We included children in the study who were admitted between January 1991 to June 1993. We defined a scald injury as one in which at least a superficial burn occurred, as assessed by the admitting plastic surgeon. We excluded from the study two children whose injuries were simple erythema. We confirmed clinical descriptions by examination of photographs and diagrams. Population data on south and west Wales came from the *Digest of Welsh Statistics*.<sup>7</sup> Those cases considered to be probably due to abuse were all recognised as such by a case conference and all the clinicians involved with the care of the child and all were placed on the child protection register.

## Results

We identified 68 children (37 boys and 31 girls) scalded in bath related hot water incidents in the period of the study. The ages ranged from 10 months to 13.5 years. The modal age was 18 months and the mean age 40.4 months. The children were predominately under 5 years of age: with 55 children aged under 5 (22 per year) and 13 between 5 and 14 years (5.2 per year). We found an incidence of bath scalds per year of: 14.7 per 100 000 children aged under 5 and 1.7 per 100 000 for children aged between 5 and 15 years.

The children admitted with bath scalds came from a population of 647 children admitted with thermal injury over the period,

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Table 1 Mode of injury

Mode of injury	Boys	Girls	Total
Falling into bath	21	17	38
Tap turned by siblings	3	7	10
Hot running tap water	5	3	8
Hand into hot water	4	1	5
Accidentally placed in hot water	1	1	2
Bath fell over	1	0	1
Likely abuse	2	2	4
Total	37	31	68

of whom 331 sustained scalds. The children sustained scalds in the bath in a number of different ways (see table 1). Details on individual modes of injury are as follows.

#### FALLING INTO THE BATH

The commonest method of acquiring bath scalds was by falling (38 cases) into hot water. Siblings had chased or pushed three of the children. Eight children were clothed at the time of the incident. There were 28 children under 5 years with a mean age of 48.2 months. The pattern of injuries in these children was varied, scalds that were irregular, asymmetrical, and in a geographical distribution. The individual areas of geographical areas of scalding were large and in most cases covered more than 2% of the body surface. The areas of scalding fitted the story when this was available. It was clear that many of the children were unsupervised at the time of the incident. There were no associated injuries in these children. The arm was involved in 28 children, the leg in 27, the front of the body in 17, the back and buttocks in 16, and the face in two. None of the cases had a clearly defined upper limit or tide mark. Two of the children had full thickness and 13 partial thickness burns.

#### TAP WATER TURNED ON BY SIBLINGS

Ten children, with a mean age of 33.4 months, were scalded when in the bath and the hot tap was turned on by a sibling. The distribution of injuries depended on the mechanism of injury. Feet (6), legs (4), and buttocks (3) were the most commonly affected areas. In the seven cases with lower body injuries, the water ran into the bath and then scalded the child; in the remaining three cases with upper body injuries, the children were scalded directly from the hot tap. The pattern of injuries was irregular scalds consistent with the story without a clear upper limit or tide mark. Two of the children had full thickness and three partial thickness burns.

#### HOT RUNNING TAP WATER

Eight children with a mean age of 34.5 months were scalded from hot running tap water without a sibling being involved. Five children were scalded by tap water that was already running to fill the bath. Two children turned the tap on themselves. An additional child was scalded from a jug of hot water that was being added to the bath. The pattern of injury was irregular scalds in all cases without a clear upper limit or tide mark. In five cases the

scalds had linear elements to them and in two cases involved the feet only. The pattern of injury was consistent with the story in all cases.

#### PUT HAND IN HOT WATER

Five children with a mean age of 31.4 months were scalded when they put their hands and arms into hot bath water. Two children were retrieving objects at the time. One put a hand into the water to maintain balance. In all cases they were quickly removed. In all cases there was superficial injury only and the upper limit of the scald was irregular with no definite tide mark.

#### ACCIDENTALLY PLACED IN TOO HOT WATER

Two children, both aged 15 months, were placed into the bath when the water was too hot and then were removed very quickly. The history was always consistent and there were no associated injuries. The percentage of scalded areas was small. One child had an immersion pattern of erythema involving both legs and buttocks with superficial burns 4% on ankles and perineum. The other child had erythema in stocking and glove distribution. She had a total of 3% deep partial thickness burns on feet and finger tips.

#### BATH FELL OVER

One boy of 25 months was injured when he stepped on the side of a portable bath. He sustained irregular scalds to his feet.

#### NON-ACCIDENTAL SCALDS

Four children (mean age 24 months) were considered likely to have sustained non-accidental injury probably by forced immersion. The injuries were symmetrical and had clear upper limits. There were associated features in all the cases (including bruises, a fractured bone, and evidence of neglect and emotional abuse). None of the cases had plausible explanations. All had severe injuries leading to permanent scarring.

### Discussion

This study has confirmed that injuries to children in the bath are a significant problem. Their prevention is a clear priority in an injury control programme for children under 5 years of age both locally and nationally. Previous experience suggests that education by itself may not be effective in preventing accidents,<sup>7-9</sup> probably because many occur at times of family psychosocial stress with safety being forgotten. An approach more likely to be effective would be reducing the temperature of the hot water in domestic systems so these accidents cannot occur. This can be done in two ways: reducing the thermostat temperature in domestic hot water tanks and more expensively by thermostatically controlled mixer taps. Reducing the temperature of domestic water tanks was suggested by

Table 2 Pointers for differentiating accidents and abuse

Accident	Forced immersion
Irregular geographical marks	Clear tide mark with more than erythema
History which fits the injuries	Story does not fit injuries or no real story
No associated injuries	Associated injuries
Asymmetrical	Symmetrical
Less likely to be severe	More likely to be severe

Feldman *et al* in 1978.<sup>6</sup> Families could be persuaded to change their water temperature or it could be changed by regulation. The Child Accident Prevention Trust publication *Burn and Scald Accidents to Children* in 1985 suggested that the temperature should be set at 54°C.<sup>10</sup> However, at present the BS 5546 specification for installation of gas hot water supplies for domestic purposes cylinder thermostat maximum temperature and the BS 5549 forced circulation system maximum are both set at 60°C. At this temperature partial thickness burns can be caused at five seconds exposure<sup>11</sup> and it may well be that water temperatures are in excess of this in many houses in Britain. We believe that water temperatures should be set at less than this in homes where there are young children.

Although many of these sad injuries are accidental, abuse does occur and its recognition is important. Some previous studies of bath scalds have not identified this as a problem. Neither Tennant and Davidson in the south east of Scotland<sup>3</sup> nor Feldman and his colleagues in Seattle<sup>6</sup> identified cases of abuse in their series. In contrast Hobbs in a study looking at the identification of abuse in burns as a whole, identified five cases from domestic hot water, four of whom were due to forced immersion.<sup>5</sup> Other studies have also identified non-accidental scald injuries as a problem.<sup>2 12 13</sup> Purdue *et al* identified six cases of 'classic forced immersion injury' and found, like we did, that these children had more severe injuries than the accidental cases.<sup>13</sup> The recognition of non-accidental scalds present difficult problems for the clinician and in particular giving evidence for court. These are significant injuries often leading to life long scarring. The numbers of cases seen by individual paediatricians are small, even if they have a special interest in child protection. The consultant plastic

surgeon may not have an extensive experience of child protection.

As well as deliberate forced immersion the stories around some of the children suggest that the boundary between accident and neglect is not a well defined one. This study and an examination of the literature has identified some factors that may be of help as pointers in recognition of abuse (see table 2).

Our findings are consistent with the pattern of injury that might be expected in a child who is held in a premeditated way in hot water where the injuries are likely to be more severe and have a clear cut off point where prolonged contact with the hot water is maintained. A child who accidentally falls into the bath or is exposed to running hot water will quickly try to withdraw and suffer irregular scalds.

We believe that more work is needed involving several centres to further clarify these issues and if possible give probabilities to individual diagnostic factors of abuse. We also believe that when a possibility of abuse exists in a child there should be a multidisciplinary investigation as has been successful in other forms of abuse. The consultant paediatrician and the consultant plastic surgeon will need to assess the child jointly with the social services. The investigation should include a skeletal survey to exclude fractures as these may not be apparent in the severely scalded child.

James Nixon was a visiting senior research fellow from the Department of Child Health, Brisbane, Queensland, Australia.

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